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AN 1999050986
PI WO 9950986 A1 19991007
AI WO 1999-US7166 A 19990331

DETD Technical advantages of the present invention include the provision of a method and apparatus for trafficking telecommunication signals having a first format over a network supporting a second format **without terminating** the
synchronous path or associated overhead portions of each is signal. Cross connecting signals having different formats **without terminating** the synchronous path or associated overhead portions of the signals provides an advantage of facilitating inexpensive switching across SONET and **SDH** networks while preserving the ability to monitor the performance of the signals being switched. Eliminating the need to terminate synchronous path and associated overhead portions of the signal saves equipment cost by eliminating the need for ports to terminate embedded signals. Avoiding termination of the synchronous path and associated overhead portion also aids to ensure signal integrity by leaving the synchronous path and associated overhead portion intact.

Network elements 12 and 112 may comprise, for example, cross connects operable to receive telecommunication signals having different formats, and to switch the contents of those signals without terminating the synchronous path or associated overhead portions of the signals. Throughout this document, the term telecommunication signal is specifically intended to encompass signals having payloads capable of carryi ng voice, video, and/or various forms of data. In the illustrated embodiment, as will be described in greater detail below, each of network elements 12 and 112 is capable of receiving and processing signals having a SONET format and signals having an **SDH** format. As discussed in detail below, the manner in which network elements 12 and 112 deal with each signal depends on the format of the particular signal. Cross connecting signals having different formats **without terminating** the synchronous path
or associated overhead portions of the signals provides an advantage of facilitating inexpensive switching across SONET and **SDH** networks while preserving the ability to monitor the performance of the signals being switched.

Matrix 34 is operable to map SONET-based SPEs into SONET-based transport signals or **SDH**-based transport signals. Similarly, matrix 34 can map **SDH**-based SPEs into **SDH**-based transport signals or SONET-based transport signals. In each of these cases, matrix 34 accomplishes its mapping function **without terminating** the synchronous path or associated overhead portions of the SPEs. This provides significant advantages in reducing system cost and ensuring signal integrity. Additional details of the function of matrix 34 will be explained later in this description.

Matrix 34 receives SONET-based SPE 28 from SPE decoder

20, and maps SONET-based SPE 28 into **SDH**-based transport signal 36 **without terminating** the synchronous path and associated overhead portion of SONET-based SPE 28, as discussed further in connection with FIGURE 2. Once SONET-based SPE 28 has been mapped into **SDH**-based transport signal 36, first network element 12 transmits **SDH**-based transport signal 36 over network 14 to second network element 112, which is located in Paris, France in this example.

SPE decoder 18 also passes **SDH**-based SPE 128 along with other SPEs 26 to matrix 34. Matrix 34 proceeds to map **SDH**-based SPE 128 into SONET-based transport signal 38, **without terminating** the synchronous path or associated overhead portion of **SDH**-based SPE 128. After mapping **SDH**-based SPE 128 into SONET-based transport signal 38, first network element 12 transmits SONET-based transport signal over SONET network 16 to a network element (not explicitly shown) in Los Angeles, California.

Matrix 34 (FIGURE 1) receives synchronous payload envelopes 26 and 28, some having the SDH format, and others the SONET format. Matrix 34 is operable to map SONET-based SPEs into SONET-based transport signals according to standards associated with the SONET format, such as Bellcore standard GR CORE. Similarly, matrix 34 is operable to map SDH-based SPEs into SDH-based transport signals according to standards associated with the SDH format, such as ITU-T standard G
In addition to mapping SONET-based SPEs into SONET-based transport signals and **SDH**-based SPEs into **SDH**-based transport signals, matrix 34 is operable to map SONET-based SPEs into **SDH**-based transport signals, and **SDH**-based SPEs into SONET-based transport signals, **without terminating** the
synchronous path or associated overhead portions of the SPEs. Matrix 34 accomplishes this direct cross-format is mapping by mapping SONET-based SPEs as if they were **SDH**-based SPEs, and mapping **SDH**-based SPEs as if they were SONET-based SPEs.

Matrix 34 accomplishes this mapping **without terminating** synchronous path and associated overhead portion 214 of STS-1 SPE 210. Cross connect 314 continues the mapping process according to the **SDH** standard and ultimately forms STM-4 signal 350, which contains the desired DS-3 signal within STS-1 SPE signal 210.

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DETD SPE decoder 118 of second network element 112 receives SDH-based transport signal 122 and extracts each SPE 126 therefrom. Among the SPEs 126 extracted from **SDH**-based transport signal 122 is SONET-based SPE 28. SPE decoder 118 can then be operable to either terminate the synchronous path and associated **overhead** portions of SONET-based SPE 28 and extract the DS-3 signals contained therein, or **pass** SONET-based SPE 28 to cross connect 134 for cross-connection and inclusion within an outgoing transport signal 136 or 138.

SPE decoder 18 also **passes** **SDH**-based SPE 128 along with other SPEs 26 to matrix 34. Matrix 34 proceeds to map **SDH**-based SPE 128 into SONET-based transport signal 38, without terminating the synchronous path or associated **overhead** portion of **SDH**-based SPE 128. After mapping **SDH**-based SPE 128 into SONET-based transport signal 38, first network element 12 transmits SONET-based transport signal over SONET network 16 to a network element (not explicitly shown) in Los Angeles, California.

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AN 1996020547
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AI WO 1995-EP4849 A 19951208

DETD The information necessary for dynamic control of the above mentioned routing operations, as well as that necessary for performance of the main network management functions, travels over data communication channels made in the SOH of the STM-Ns, which also comprises the information for maintaining the synchronizing of the STM-N frames at the various points of the network. Functionally, the SOH is divisible in two suboverheads termed Regenerator Section **Overhead** (RSOH) and Multiplex Section **Overhead** (MSOH), distinguishing between the two possible connection types within the network of FIG. 1. The information contained in the RSOH is accessible both to the regenerators and the **SDH** multiplexes while that contained in the MSOH is accessible only to the multiplexes and therefore passes unaffected **through** the regenerators. The suboverheads RSOH and IVISOH are divisible in diversely named bytes with which are associated very precise functions among which is data communication. For the latter purpose, in the RSOH there are used UN bytes to supply N 2-way 192 kbit/s data channels directed to the alarm, maintenance, control, monitoring and administration messages, and additional communications requirements between two sections processing the RSOH. in the MSOH are used 9xN bytes to supply N 576 kbit/s 2-way data channels (not accessible to the regenerators) for purposes similar to those of the RSOH. The above mentioned channels are indicated by the symbol DCC (Data Communication Channel) and in particular DCCR or DCCM if coming from RSOH or MSOH respectively. They constitute the physical level for support of logical control channels termed Embedded Control Channel (ECC) for data communication within the SDH network.

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AN 1997049210
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AI WO 1997-US10025 A 19970611

DETD Fig. 5 shows a block diagram of the transmitter portion 300 of a **PDH** system of the present invention (called the Synchronous **PDH** system). Fig. 6 shows a block diagram of the receiver portion 400 of the SPDH system. The SPDH is system of the present invention uses the parallel octet transmission characteristics of a mB/nB digital CODEC to **bypass** the final stage of multiplexing. An example of a suitable CODEC is a 513/613 chipset manufactured by AMD called transparent asynchronous xmittcr-receiver interface, or TAXI, and having a part number of AM7968 for the transmitter and AM7969 for the receiver. The intermediate high speed tributary data stream, such as E2 or E3 data streams, are directly entered into the mB/nB CODEC as a single octet. Other overhead channel data can also be processed

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synchronous path or associated overhead portions of each is signal. Cross connecting signals having different formats **without terminating** the synchronous path or associated overhead portions of the signals provides an advantage of facilitating inexpensive switching across SONET and **SDH** networks while preserving the ability to monitor the performance of the signals being switched. Eliminating the need to terminate synchronous path and associated overhead portions of the signal saves equipment cost by eliminating the need for ports to terminate embedded signals. Avoiding termination of the synchronous path and associated overhead portion also aids to ensure signal integrity by leaving the synchronous path and associated overhead portion intact.

Network elements 12 and 112 may comprise, for example, cross connects operable to receive telecommunication signals having different formats, and to switch the contents of those signals without terminating the synchronous path or associated overhead portions of the signals. Throughout this document, the term telecommunication signal is specifically intended to encompass signals having payloads capable of carryi ng voice, video, and/or various forms of data. In the illustrated embodiment, as will be described in greater detail below, each of network elements 12 and 112 is capable of receiving and processing signals having a SONET format and signals having an **SDH** format. As discussed in detail below, the manner in which network elements 12 and 112 deal with each signal depends on the format of the particular signal. Cross connecting signals having different formats **without terminating** the synchronous path
or associated overhead portions of the signals provides an advantage of facilitating inexpensive switching across SONET and **SDH** networks while preserving the ability to

monitor the performance of the signals being switched.

Matrix 34 is operable to map SONET-based SPEs into SONET-based transport signals or **SDH**-based transport signals. Similarly, matrix 34 can map **SDH**-based SPEs into **SDH**-based transport signals or SONET-based transport signals. In each of these cases, matrix 34 accomplishes its mapping function **without terminating** the synchronous path or associated overhead portions of the SPEs. This provides significant advantages in reducing system cost and ensuring signal integrity. Additional details of the function of matrix 34 will be explained later in this description.

Matrix 34 receives SONET-based SPE 28 from SPE decoder 20, and maps SONET-based SPE 28 into **SDH**-based transport signal 36 **without terminating** the synchronous path and associated overhead portion of SONET-based SPE 28, as discussed further in connection with FIGURE 2. Once SONET-based SPE 28 has been mapped into **SDH**-based transport signal 36, first network element 12 transmits **SDH**-based transport signal 36 over network 14 to second network element 112, which is located in Paris, France in this example.

SPE decoder 18 also passes **SDH**-based SPE 128 along with other SPEs 26 to matrix 34. Matrix 34 proceeds to map **SDH**-based SPE 128 into SONET-based transport signal 38, **without terminating** the synchronous path or associated overhead portion of **SDH**-based SPE 128. After mapping **SDH**-based SPE 128 into SONET-based transport signal 38, first network element 12 transmits SONET-based transport signal over SONET network 16 to a network element (not explicitly shown) in Los Angeles, California.

Matrix 34 (FIGURE 1) receives synchronous payload envelopes 26 and 28, some having the SDH format, and others the SONET format. Matrix 34 is operable to map SONET-based SPEs into SONET-based transport signals according to standards associated with the SONET format, such as Bellcore standard GR CORE. Similarly, matrix 34 is operable to map SDH-based SPEs into SDH-based transport signals according to standards associated with the SDH format, such as ITU-T standard G
In addition to mapping SONET-based SPEs into SONET-based transport signals and **SDH**-based SPEs into **SDH**-based transport signals, matrix 34 is operable to map SONET-based SPEs into **SDH**-based transport signals, and **SDH**-based SPEs

into SONET-based transport signals, **without terminating** the synchronous path or associated overhead portions of the SPEs. Matrix 34 accomplishes this direct cross-format is mapping by mapping SONET-based SPEs as if they were **SDH**-based SPEs, and mapping **SDH**-based SPEs as if they were SONET-based SPEs.

Matrix 34 accomplishes this mapping **without terminating** synchronous path and associated overhead portion 214 of STS-1 SPE 210. Cross connect 314 continues the mapping process according to the **SDH** standard and ultimately forms STM-4 signal 350, which contains the desired DS-3 signal within STS-1 SPE signal 210.